

WE CLAIM:

- 1 1. A serial communications system comprising:
- 2 a scrambler for converting received data into scrambled data; and
- 3 an ECC encoder for converting said scrambled data into ECC-encoded data.
- 1 2. The system as recited in Claim 1, further comprising:
- 2 a serializer for converting said ECC-encoded data into serialized data;
- 3 wherein the ECC-encoded data includes frame alignment information; and
- 4 the system further comprises a receiver for receiving said serialized data and
- 5 converting the serialized data into data frames based upon the frame alignment information.
- 1 3. The system as recited in Claim 2, wherein the receiver comprises:
- 2 a frame-recoverer for converting said serialized data into data frames;
- 3 an ECC decoder for converting said data frames into ECC-decoded data and
- 4 error indications; and
- 5 a scrambler for converting said ECC-decoded data into de-scrambled data.
- 1 4. The system as recited in Claim 5, wherein said frame-recoverer uses said error
- 2 indications in converting said serialized data into data frames.
- 1 5. The system as recited in Claim 1, wherein said ECC encoder applies an error
- 2 correction code in converting said scrambled data into said ECC-encoded data.

- 1 6. A serial communications method, comprising the steps of:
2 converting received data into scrambled data; and
3 converting said scrambled data into ECC-encoded data.
- 1 7. The method as recited in Claim 6, further comprising the steps of:
2 generating a serial stream of the ECC-encoded data; and
3 transmitting said serial stream.
- 1 8. The method of Claim 7, wherein:
2 the ECC-encoded data includes frame alignment information; and
3 the method further comprises receiving said serialized data and converting said
4 serialized data into data frames based upon said frame alignment information.
- 1 9. The method of Claim 7, further comprising:
2 receiving said serialized data;
3 converting said serialized data into data frames;
4 converting said data frames into ECC-decoded data and error indications; and
5 converting said ECC-decoded data into de-scrambled data.
- 1 10. The method of Claim 9, wherein the step of converting the serialized data
2 comprises converting the serialized data into data frames based upon said error indications.

1 11. A serial communications system comprising:
2 an ECC decoder for converting data frames into ECC-decoded data; and
3 a de-scrambler for converting said ECC-decoded data into de-scrambled data.

1 12. The system of Claim 11, further comprising a frame-recoverer for converting
2 serialized data into said data frames.

1 13. The system as recited in Claim 12, wherein:
2 said ECC decoder generates error indications; and
3 said frame-recoverer uses said error indications in converting said serialized
4 data into said data frames.

1 14. The system as recited in Claim 13, wherein said frame-recoverer generates a
2 frame clock that is shifted in phase based upon said error indications, said frame-recoverer
3 converting said serialized data into said data frames using said frame clock..

1 15. The system as recited in Claim 14, wherein said frame-recoverer shifts in
2 phase said frame clock by a predetermined number of periods of a bit clock based upon said
3 error indications.

1 16. The system as recited in Claim 13, wherein said frame-recoverer comprises:
2 a plurality of registers, each register being controlled to receive said serialized
3 data and form two or more frames of parallel data therefrom;
4 a selection control circuit for receiving said error indications and generating at
5 least one control signal; and
6 selection circuitry coupled to receive as inputs the output of said registers and
7 said control signal from said selection control circuit, and output a set of parallel data
8 appearing at the input of said selection circuitry, said number of bits in said set of parallel
9 data corresponding to the number of bits in a frame of data.

1 17. The system as recited in claim 16, wherein
2 the selection circuitry comprises a plurality of individual multiplexer circuits,
3 the number of multiplexer circuits corresponding to the number of bits n in a frame of data,
4 each multiplexer circuit being an n+1:1 multiplexer circuit.

1 18. The system as recited in Claim 13, wherein said error indications are
2 associated with errors in said data frames, said ECC-decoder correcting some of said errors.

1 19. A serial communications system comprising:
2 an ECC decoder for converting data frames into ECC-decoded data and error indications; and
3 a frame recoverer for converting serialized data into said data frames using
4 said error indications.

1 20. The system as recited in Claim 19, wherein said frame-recoverer generates a
2 frame clock that is shifted in phase based upon said error indications and converts said
3 serialized data into said data frames using said frame clock.

1 21. The system as recited in Claim 20, wherein said frame-recoverer shifts in
2 phase said frame clock by a predetermined number of periods of a bit clock based upon said
3 error indications.

1 22. The system as recited in Claim 19, wherein said frame-recoverer comprises:
2 a plurality of registers, each register being controlled to receive said serialized
3 data and form two or more frames of parallel data therefrom;
4 a selection control circuit for receiving said error indications and generating at least
5 one control signal; and
6 selection circuitry coupled to receive as inputs the output of said registers and
7 said control signal from said selection control circuit, and output a set of parallel data
8 appearing at the input of said selection circuitry, the number of bits in said parallel set of data
9 corresponding to the number of bits in a frame of data.

1 23. The system as recited in claim 22, wherein
2 the selection circuitry comprises a plurality of individual multiplexer circuits,
3 the number of multiplexer circuits corresponding to the number of bits n in a frame of data,
4 each multiplexer circuit being an $n+1:1$ multiplexer circuit.

1 24. The system as recited in Claim 19, wherein said error indications are
2 associated with errors in said data frames, said ECC-decoder correcting some of said errors.

1 25. The system as recited in claim 19, further comprising:
2 a de-scrambler for converting said ECC-decoded data into de-scrambled data.

1 26. A serial communications method comprising:
2 converting serialized data into data frames as a function of error indications;
3 and
4 converting said data frames into ECC-decoded data and said error indications.

1 27. The method as recited in Claim 26, further comprising:
2 de-scrambling said ECC-decoded data into de-scrambled data.

1 28. The method as recited in Claim 26, wherein the step of converting said
2 serialized data comprises:
3 generating a frame clock that is shifted in phase based upon said error
4 indications; and
5 converting said serialized data into said data frames using said frame clock.

1 29. The method as recited in claim 26, wherein the step of converting said
2 serialized data comprises:
3 temporarily maintaining bits of said serialized data sufficient to form two or
4 more frames of parallel bits;

5 selecting a frame of data from said maintained bits based upon said error
6 indications, said frame of data being a frame of data in the data frames; and
7 repeating said steps of temporarily maintaining and selecting for generating
8 each data frame from said serialized data.

1 30. The method as recited in claim 26, further comprising:
2 initially scrambling received data into scrambled data;
3 converting said scrambled data into ECC-encoded data; and
4 converting said ECC-encoded data into said serialized data.

1 31. A serial communications method comprising:
2 converting data frames into ECC-decoded data and error indications; and
3 de-scrambling said ECC-decoded data into de-scrambled data.

1 32. The method as recited in Claim 31, further comprising:
2 initially converting serialized data into said data frames as a function of said
3 error indications.

1 33. The method as recited in claim 31, further comprising:
2 initially scrambling received data into scrambled data; and
3 performing an ECC encoding operation on said scrambled data to generate
4 said data frames.

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